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Posterior Shoulder Instability Classification, Assessment, and Management: An International Delphi Study

OBJECTIVE: To reach consensus among international shoulder experts on the most appropriate assessment and management strategies for posterior shoulder instability (PSI).

DESIGN: Delphi.

METHODS: In phase 1 of the study, we reviewed the literature, generated the Delphi items, created the survey, and identified clinical experts. In phase 2 of the study, clinical shoulder experts (physical therapists, orthopaedic surgeons, sports medicine physicians, and researchers) participated in a 3-round e-Delphi survey. For consensus, we required a minimum of 70% agreement per round. Descriptive statistics were used to present the characteristics of the respondents, the response rate of the experts in each round, and the consensus for PSI classification, assessment, and management.

RESULTS: Round 3 was completed by 47 individuals from 5 different countries. The response rate ranged from 57/70 (81%) to 47/50 (94%) per round. Respondents agreed on 3 subgroups to define PSI: traumatic (100% agreement), microtraumatic (98% agreement), and atraumatic (98% agreement).

CONCLUSION: International shoulder experts agreed that the clinical presentation, management strategy, and outcome expectations differ for traumatic, microtraumatic, and atraumatic PSI. Their recommendations provide a framework for managing these subgroups, with additional consideration of sport and work participation and subsequent risks. *J Orthop Sports Phys Ther 2020;50(7):373-380. Epub 29 Apr 2020. doi:10.2519/jospt.2020.9225*

KEY WORDS: *classifications, Delphi, PSI, subgroups*

Posterior shoulder instability (PSI) is challenging to diagnose, and prioritizing management options can be difficult.[8,29,30] Prior literature reported that the incidence of PSI ranges from 1.0% to 3.8% of all dislocations,[4,23,36] and PSI currently constitutes approximately 10% of all instability events.[25,26] Up to 1 in 4 surgically managed shoulder instabilities have a component of posterior instability.[1,2,21,39]

There is weak evidence to guide the clinician on what to include in the clinical assessment of PSI.[10] A patient may describe pain in the posterior glenohumeral joint,[3] a sensation of joint looseness,[14] or provocation of symptoms during sport[7,8,37,45] and activities of daily living.[20,37,46] Recurrent, position-specific symptoms occur in patients without a specific injury event or mechanism.[32] Patients may have a history of repetitive movement into the symptom-provoking position of flexion, adduction, and internal rotation (eg, in volleyball, baseball, and football).[3,30,31]

Direction of instability (unidirectional, bidirectional, and/or multidirectional),[1,3,14] mechanism of injury (traumatic, microtraumatic, and/or atraumatic),[3,29,30] and degree of injury (subluxation, reduced dislocation, and/or nonreduced dislocation)[3,31,33] may help the clinician diagnose PSI. The terms *microtraumatic* and *atraumatic* have been suggested as subgroups of PSI but are not well differentiated.[40] Subgrouping may assist with prognostic outcomes for both nonsurgical and surgical management of PSI.

Nonsurgical management of atraumatic PSI is promoted as the appropriate initial treatment, despite little supporting evidence.[19,34,41] Appropriate nonsurgical care has yet to be well defined and supported in traumatic PSI.[22,42] Surgery is often recommended for traumatic dislocations.[13,15,35]

Given the lack of empirical evidence to guide classification, assessment, and management of PSI, expert consensus may enhance a pathway of care for PSI and define areas for future clinical research. One strategy to achieve consensus is the Delphi method.[9,11,38]

The purpose of this study was to reach consensus among international shoulder experts on the most appropriate clinical assessment and management strategies for PSI.

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METHODS

Study Design

A Delphi study collects information through a series of successive surveys, completed by experts over a large geographical region, with a feedback loop to allow the authors to revise responses to the panel.[17,24,47] A 3-round e-Delphi study[11] was conducted from June 2017 to January 2018. This survey design allowed for respondent anonymity while providing the experts with synthesized results from each round. This study received approval through the Western University Health Science Research Ethics Board.

Phase 1

Literature Review Prior to commencing the Delphi study, 2 systematic reviews were completed.[10,22] An up-to-date search of the prior databases and gray literature (Google Scholar, Physiopedia) occurred from November 2014 to November 2016.

Generation of the Delphi Items and Survey Questions The prior systematic reviews, an updated literature search, and the expertise of the research team informed the Delphi items and survey questions. The research team comprised 4 shoulder experts (1 orthopaedic surgeon, 2 physical therapists, and 1 upper extremity clinical researcher) and 4 experienced physical therapists, who reviewed the literature to help extract items to support the purpose of our study. Upon completion of the literature review, the research team extracted and organized information into 7 categories: (1) classification of PSI, (2) subjective examination, (3) objective examination, (4) prognosis and risk, (5) clinical outcome measures, (6) therapeutic interventions and strategies in nonsurgical PSI, and (7) medical management in traumatic PSI.

A series of group meetings, discussions, and multiple revisions within the research team allowed for the development of questions within the 7 categories. These questions were reviewed, refined, and eventually narrowed down to a 50-item survey (**APPENDIX A**, available at www.jospt.org). Nine clinicians provided feedback on survey construction, question clarity, redundancy, the importance of the items selected, and barriers to survey completion (**APPENDIX B**, available at www.jospt.org).

Revised questions were subsequently programmed into internet-based survey design software (SurveyMonkey, San Mateo, CA). We used 2- to 4-point Likert scales and free-text response options.

Expert Recruitment We identified potential participants (physical therapists, sport medicine physicians, orthopaedic surgeons, and clinical researchers with expertise in treating shoulder problems) through our research and clinical networks in North America, Europe, and Australia, and through snowball recruitment.[17] We contacted 70 experts and invited them to participate in 3 rounds of Delphi consensus development. The **FIGURE** outlines the phases of our Delphi methods.

We identified experts as clinicians who had specialty training in surgery or physical therapy of the shoulder, experience in treating shoulder conditions as a major component of their practice, and at least 5 years of experience in managing shoulder instability. Expert clinical researchers had previous clinical experience managing shoulder instability and had published on this topic.

The validity and reliability of observations obtained using the Delphi method improve when a panel includes at least 10 individuals.[16,38] To reduce nonresponse and respondent dropout, a letter of participation and consent was submitted to expert participants and included expected survey completion time and a schedule of subsequent survey rounds.[12]

Phase 2

In round 1, we sent an online survey of 50 questions by e-mail to the 70 shoulder experts, including an explanation of the objectives of the study and specific instructions for participation. All experts were asked to complete the first 41 questions, and physicians and surgeons completed an additional 9 questions. Each expert was asked to respond using the assigned Likert scales and was given an opportunity to provide comments and suggest additional items that might not have been included in the development of the initial statement list. Agreement of 70% on individual items was our predefined threshold for consensus.[18] Statements not meeting 70% agreement were amended according to feedback and redistributed to the experts for Delphi rounds 2 and 3.

Round 2 was delivered 4 to 6 weeks following completion of round 1, pro-

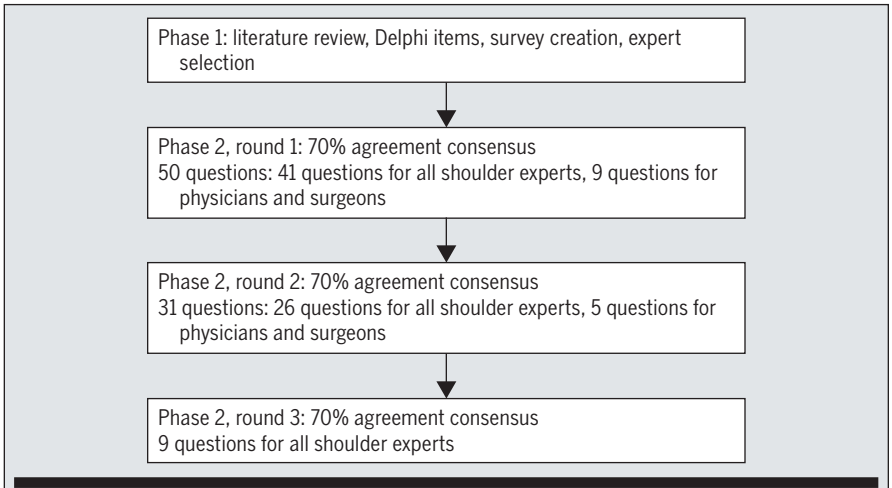

FIGURE. Outline of the Delphi process.

viding time for the research team to analyze and revise the questionnaire for round 2. Statements that did not meet our threshold for consensus were either modified or removed, based on feedback. Experts were provided with summarized group results of round 1. Round 2 had 41 questions, and all experts were asked to complete the first 36 questions. The final 5 questions were completed by physicians and surgeons only. The protocol of round 3 was similar to that of round 2 and incorporated results from the previous round. Round 3 had 9 questions completed by all experts. Anonymity of respondents was maintained through this phase for both experts and the research team.

Statistical Analysis

Descriptive statistics were used to present the characteristics of the respondents, the response rate of the experts for each round, and the consensus on PSI classification, assessment, and management.

RESULTS

In round 1, the Delphi panel included 70 shoulder experts, and 47 respondents completed the final round. Respondents in the final round were from 5 different countries, with Canada having the largest representation at 24/47 (51%). The response rate ranged from 57/70 (81%) respondents in round 1 to 47/50 (94%) in round 3. The majority of the shoulder experts were physical therapists (38%), orthopaedic surgeons (34%), and shoulder clinical researchers (15%). Most respondents (96%) had more than 10 years of clinical experience treating patients with PSI (**TABLE 1**).

After round 1, respondents reached consensus on 34 of the 50 questions. The 16 questions that respondents did not reach consensus on were related to clinical orthopaedic tests, self-report outcome measures, rehabilitation management, immobilization timelines, indications for surgery, and return-to-sport timelines. We created 41 questions for round 2. There was consensus on 33 of 41 questions. The round 3 survey contained 9 questions. All questions within round 3 achieved consensus.

We identified 3 PSI subgroups based on mechanism, direction, and type of injury:

1. *Traumatic*: acute injury that provides an immediate and/or forceful impact that causes posterior or posteroinferior dislocation of the humerus on the glenoid (100% agreement)
2. *Microtraumatic*: posterior or posteroinferior subluxation more than dislocation of the humerus on the glenoid, with or without degenerative changes, and associated with gradual or acute overload of the musculature (98% agreement)
3. *Atraumatic*: subluxation of the glenohumeral joint in a posteroinferior direction or multidirection due to congenital and/or systemic laxity of the ligamentous, labral, or capsular glenohumeral structures and/or congenital anomalies of the bony glenoid or humerus (98% agreement)

Clinical history questions related to age of the patient (84% agreement) and goals of treatment (96% agreement) should be explored, and clinical symptoms reported may not be specifically related to instability, but rather to weakness or diminished performance (98% agreement) (**APPENDIX C**, available at www.jospt.org). The predominant functional limitations for all 3 subgroups were similar and had a range of agreement between 78% and 96% (**TABLE 2**). **APPENDIX C** summarizes the clinical assessment agreement for all patients with PSI prior to subgrouping. **TABLE 2** and

TABLE 1 Response Rate and Characteristics of Round 3 International Shoulder Experts[a]

	Value
Response rate	
Round 1 (n = 70)	57 (81)
Round 2 (n = 57)	50 (88)
Round 3 (n = 50)	47 (94)
Round 3 (n = 47)	
Country	
Australia	12 (26)
Belgium	2 (4)
Canada	24 (51)
England	1 (2)
United States	8 (17)
Specialties	
Clinical researchers (physical therapists/physicians)	7 (15)
Orthopaedic surgeons	16 (34)
Physical therapists	18 (38)
Radiologists	1 (2)
Sports medicine physicians	5 (11)
Time in practice >10 y	45 (96)
Patients with PSI treated per year	
1-9	10 (21)
10-19	17 (36)
20-49	12 (26)
>50	8 (17)

Abbreviation: PSI, posterior shoulder instability.
[a]*Values are n (percent).*

APPENDIX D (available at www.jospt.org) summarize clinical assessment agreement based on the 3 PSI subgroups.

TABLE 3 and **APPENDIX D** summarize management and recovery timelines for PSI subgroups.

DISCUSSION

This study reports an international agreement on the classification of PSI by subgrouping based on mechanism of injury, clinical assessment, management, recovery timelines, risk factors, and outcome measures. Assessment, management, and clinical outcome measurement of PSI lack consensus and gold standard care.[8,10,22]

TABLE 2 Clinical Assessment of Posterior Shoulder Instability Subgroups[a]

Clinical Assessment	Traumatic	Microtraumatic	Atraumatic
Mechanism of injury	• Fall or unexpected WB into shoulder horizontal adduction/IR between 60° and 140° of flexion (85%)	• Tasks that involve repetitive or increased load with pushing or WB through straight arm or reaching across body or overhead tasks (94%)	• Tasks that involve pushing or WB through straight arm, reaching across body (92%) • Repetitive activities overhead or in flexion/adduction/IR (79%)
Type of injury (acute or functional) and direction of dislocation or subluxation	• Acute injury (98%) • Posterior (98%) or posteroinferior dislocation (96%)	• Functional subluxations (85%) • Episodic: <3 subluxations per year (86%) • Chronic: >3 subluxations per year (84%) • Posterior (77%) and posteroinferior subluxation more than dislocation (76%)	• Functional subluxation (94%) • Chronic: >3 subluxations per year (94%) • Posteroinferior subluxations (84%) • Multidirectional subluxations (96%)
Questions to ask	• Do you remember your shoulder position at time of injury? (100%) • When was your initial injury? (96%)	• Did this problem begin due to a single event or over time? (96%)	• Do you have other joints in your body that you can dislocate or subluxate? (100%) • Do you have a family history of connective tissue disorders (eg, Ehlers-Danlos, Marfan, general hypermobility syndrome) (100%)
Sports/occupations at risk	• Contact sports: football (American and Australian), rugby, ice hockey (98%) • Occupations: military, police, firefighter (98%) • Fall-risk sports: cheerleading, skateboarding, figure skating (94%) • Combat sports: karate, judo, wrestling, jiujitsu (85%) • Performing artists: acrobat, martial artist, stunt performer (81%)	• Highly repetitive demands into horizontal flexion/adduction/IR of the shoulder (100%) • Overhead activity: baseball pitcher, tennis player, swimmer, laborer (94%) • Performing artists: acrobat, dancer, martial artist, stunt performer (90%) • Overhead activity with heavy load: weightlifter (89%)	• Highly repetitive demands into horizontal flexion/adduction/IR of the shoulder (92%) • Performing artist: acrobat, dancer, martial artist, stunt performer (73%) • Weightlifter (73%)
Symptoms/signs	• Acute pain with loss of shoulder ROM in all directions (94%) • Shoulder feels unstable (94%) • Posterior greater than anterior GH pain (82%)	• Catch/click with shoulder motion (96%) • Arm fatigues easily (94%) • Night pain/disturbed sleep (92%) • Functional instability: self-subluxation (84%)	• Arm fatigues easily (92%) • Functional instability: self-subluxation (90%) • Night pain/disturbed sleep (90%) • Catch/clunk with shoulder motion (86%) • Nerve-like pain in arm (84%) • Intolerance to lying on affected side (79%)
Active motion	• Initially, all shoulder ROM will be limited • Limited range: ER and/or HBB (85%) • Horizontal flexion/adduction/IR pain or apprehension (85%)	• Aberrant active shoulder and scapular motion (90%) • Apprehension with horizontal flexion/adduction/IR (87%) • Decreased or locked ER (87%)	• Aberrant active shoulder and scapular motion (96%) • Decreased or locked external rotation (91%) • Apprehension with horizontal flexion/adduction/IR (91%)
Tests or cluster of tests	• Posterior apprehension, jerk, and Kim tests (92%) • Posterior load and shift (85%) • Posterior drawer (80%)	• Posterior apprehension or jerk test (100%) or • Subjective history and posterior apprehension, and scapular and/or humeral head repositioning with symptom or strength improvement (80%)	• Subjective history and Beighton score >4/9, positive sulcus test, and scapular and/or humeral head repositioning with symptom or strength improvement (93%)
Strength deficits	• Acute dislocation: all strength tests would be painful and weak (79%)	• Weak scapular upward rotators (ie, upper/lower trapezius, serratus anterior) (74%)	• Weak scapular upward rotators and outer ranges of overhead GH ROM (78%)
Functional limitations	• Intolerance in WB or pushing through their arms (eg, plank push-up, bench press, pushing open a door) (88%-96%) • Reaching across the body (eg, putting on a seatbelt, brushing teeth, pulling off a shirt/bra) (78%-94%)		
Outcome measures	• Self-report outcome measure: frequency of subluxations/dislocations over a year (96%), WOSI (96%), NPRS (91%), SANE (89%) • Functional outcome measure: any clinically relevant form of testing for sport, occupation, or ADL (eg, lifting overhead, reaching across body with/without resistance, swimming, pushing out of a chair) (94%)		

Abbreviations: ADL, activities of daily living; ER, external rotation; GH, glenohumeral; HBB, hand behind back; IR, internal rotation; NPRS, numeric pain-rating scale; ROM, range of motion; SANE, Single Assessment Numeric Evaluation; WB, weight bearing; WOSI, Western Ontario Shoulder Instability Index.
[a]Values in parentheses are percent agreement. See **APPENDICES C** *and* **D** *for additional assessment agreement details.*

PSI Subgroups

Many authors support[14,30,32] the need for classification of PSI based on 3 broad etiological categories: acute traumatic, microtraumatic, and atraumatic. However, few clinical studies report results according to these different groups, making it difficult to define how presentation or management differs across these theoretically informed subgroups. Subgroup classification may assist with early diagnosis of PSI and management. Accurate directional diagnosis of PSI, based on mechanism and clinical evaluation, may help reduce the high rates of recurrence that have been attributed to misdiagnosis of bidirectional and multidirectional instability.[8,27] Through all rounds of our Delphi process, there was extremely high agreement (98%-100%) on the definitions associated with traumatic, microtraumatic, and atraumatic etiologies for PSI. Experts typically associated the term *dislocation* with acute traumatic injury and *subluxation* with microtraumatic and atraumatic mechanisms.[4,5]

Clinical Assessment

There was consensus about the clinical assessment for type of injury, clinical questions to ask, and sports/occupations at risk. These history-taking items are essential to help identify PSI and its appropriate subgrouping. Clinical history alone may be sufficient for diagnosing injuries 76% of the time.[28]

The type of injury and dislocation and/or subluxation varied between subgroups. Traumatic PSI was considered to involve an acute posterior (98% agreement) or posteroinferior dislocation (96% agreement). Microtraumatic was considered more likely to be characterized by episodic subluxations (fewer than 3 subluxations per year; 86% agreement), and atraumatic PSI was considered to have a more chronic subluxation history (greater than 3 subluxations per year; 94% agreement). Shoulder experts agreed (98% agreement) that participation in contact sports (football, rugby) had a higher risk of acute traumatic PSI, which correlates well with recent studies.[5,21] There was 73% agreement

TABLE 3 Management and Timelines for Posterior Shoulder Instability Subgroups[a]

	Traumatic (acute trauma)	Microtraumatic	Atraumatic
Medical management[b]	• X-ray prior to reduction (97%) • Closed reduction in ED (86%) • Immobilization[c] (74%) • Nonopioid-based medication (86%) • NSAIDs (75%) • Refer to physical therapy (77%) • Recommend elbow and wrist ROM exercises (84%)	• Refer to physical therapy (96%) • Modify or limit horizontal adduction, flexion, and internal rotation initially (92%) • NSAIDs only during acute phase (75%) • Immobilization[c] post reduction only (74%)	• Refer to physical therapy (96%) • Modify or limit horizontal adduction, flexion, and internal rotation initially (92%) • NSAIDs only during acute phase (75%) • Immobilization[c] post reduction only (74%)
Surgical management[d]	• Large bony structural lesion (89%) • Fragment fixation >25% (79%) • Labral repair (76%) • After 3 mo if unsuccessful nonsurgical management (86%)	• Referral for surgery should be considered after 6 mo of unsuccessful nonsurgical management (73%)	• Referral for surgery should be considered after 6 mo of unsuccessful nonsurgical management (77%)
Physical therapy management	• Limit arm-across-body activities during acute/irritable phase (92%) • Scapular, rotator cuff, and sport/occupation-specific strength training as needed (92%) • Minimum of 12 wk of individualized exercise progression (87%)	• Assess and manage scapular and/or humeral head position (100%) • Scapular, rotator cuff, and sport/occupation-specific strength training (98%) • Exercise progression should encompass local and global muscles (72%)	• Assess and manage scapular and/or humeral head position (100%) • Scapular, rotator cuff, and sport/occupation-specific strength training (98%) • Exercise progression should encompass local and global muscles (72%)
Management	• Education: rehabilitating shoulder for optimal motor control and strength (81%), anatomy/pathomechanics (78%), pain coping strategies (72%). Patients are knowledgeable about their condition and understand the value of rehabilitation (98%) • Home-based exercise program: motivation and knowledge to perform at home (100%), high expectations of success (94%) • Clinician-supervised exercise program: low efficacy (83%), requires verbal and tactile feedback (100%), poor support at home (81%), lacks insight into exercises (90%), and sedentary lifestyle (75%)		
Timelines	• Pain, ADL recovery: 6-12 wk (77%) • Immobilization[c]: 1-3 wk (81%) • Return to high-risk sport/work post immobilization and 3-6 mo of physical therapy (70%) based on individualized discussion with patient • Return to high-risk sport/work post surgery and 6-12 mo of physical therapy (96%) based on individualized discussion with patient		

Abbreviations: ADL, activities of daily living; ED, emergency department; NSAID, nonsteroidal anti-inflammatory drug; ROM, range of motion.
[a]*Values in parentheses are percent agreement. See* **APPENDICES C** *and* **D** *for further management agreement details.*
[b]*Physician and surgeon agreement values only.*
[c]*Immobilization in 30° of external rotation/neutral abduction.*
[d]*Surgeon agreement values only.*

for increased risk of atraumatic PSI in performance-based sports and weightlifting, which concurs with elevated rates reported in the literature.[44]

A physical examination complements a patient's history and is useful to assist with diagnosis. The PSI clinical tests reported in the literature are the jerk test and Kim test.[10] There was consensus that the jerk test, Kim test, and posterior apprehension test (92%-100% agreement) were useful. All 3 were similar in perceived clinical value, thus clinician preference and experience should be considered when selecting between tests.[10] Despite consensus on these physical tests and/or a cluster of tests (74%-100% agreement), the reported diagnostic accuracy values of these tests are low when interpreted independently, and the tests have never been studied in a cluster.[10,28,43] The combination of clinical history and physical examination may improve diagnostic accuracy[28] (**TABLE 2** summarizes the 10 consensus recommendations for clinical assessment).

Management

Classifying PSI based on mechanism of injury and standardizing clinical assessment could enhance decision making for nonoperative prognosis, treatment, and return-to-activity guidelines. Management of acute traumatic posterior dislocation has been the most consistently reported.[21,39] Male intercollegiate athletes participating in wrestling, rugby, and football had an 8-times higher risk of PSI and were more likely to require surgical treatment.[21] Other studies have shown only a 19% success rate with nonsurgical management of traumatic PSI.[6,14]

There was consensus among the orthopaedic surgeons and physicians on immediate surgical referral following acute trauma if there was a large structural bony lesion visible on X-ray (89% agreement) or after 3 months of unsuccessful nonsurgical management (86% agreement). Referral for surgical management within the microtraumatic and atraumatic subgroups is controversial, and nonsurgical management should be considered first.[22,29] Specific surgical management was beyond the scope of our study, and indications for orthopaedic referral have not been standardized.[15,20]

Nonsurgical management for microtraumatic and atraumatic PSI has a success rate of 70% to 89%.[6,14,21] We found high agreement for management of microtraumatic and atraumatic PSI with the following physical therapy treatments: improving scapular position and humeral head position (100% agreement), rotator cuff and sport/occupation-specific training (98% agreement), and exercise progressions that encompass local and global muscles (72% agreement). This rehabilitation approach is supported by a recent randomized controlled trial[44] for patients with multidirectional instability. There is a dearth of well-designed nonoperative management options for PSI. This may be due to the weak identification of various subgroups within PSI (**TABLE 3** summarizes the 5 consensus recommendations for management).

Outcome Evaluation and Return to Activity

Reaching consensus on standardized outcome measures and timelines to return to high-risk sport and work was challenging. All 3 rounds were required to achieve threshold consensus, and results for the outcome measures are likely related to regional preferences of the experts. For example, the Western Ontario Shoulder Instability Index (WOSI) had 96% agreement; however, half the experts were from Canada, where this measure was developed. The lack of standardized PSI outcome measures is reflected within the DeLong et al[8] systematic review, which listed 29 functional outcome measures in 29 PSI studies. Our Delphi study supports the need to develop specific PSI outcome measures based on an understanding of the subgroups and their clinical patterns. By round 2, consensus on immobilization time (81% agreement) and on recovery time for pain and activities of daily living (77% agreement) was consistent in all 3 subgroups. Three Delphi rounds were required to achieve consensus thresholds for the return to high-risk sports and occupations for both nonoperative management (3-6 months) and/or surgery (6-12 months). There is limited evidence to support these timelines.[44]

Strengths and Limitations

Our study reflects the expertise of experienced international clinicians and researchers from 5 different countries with case loads that include PSI. We had a high response rate from the shoulder experts for each round. Although there was a gradual attrition to 47 experts, the final round represented a substantial and adequate sample.

Some limitations should be considered when interpreting our consensus. Item generation and formulation for the Delphi rounds involved systematic reviews and a literature search that incorporated "English only" as an inclusion criterion. This search might have missed relevant papers, although, given our pool of international experts, the likelihood and potential impact were minimized. Half of the shoulder experts were from Canada, the region that led the project. This might have influenced perceptions and experiences with regard to prognostic factors, such as common sport activities. Further, the management of injury might have been affected by the infrastructure associated with a publicly funded health care system. The results of this survey are geographically limited to the 5 countries represented by the shoulder experts. The consensus reached may be biased by the type of experts included, with physical therapists (38%) and orthopaedic surgeons (34%) comprising the majority of the shoulder experts. Future studies should examine the validity of our findings across different clinical settings or professions.

CONCLUSION

Clinical presentation, management strategy, and outcome expectations differ for traumatic,

microtraumatic, and atraumatic PSI. The recommendations achieved provide a framework for managing these subgroups, with additional consideration of sport and work participation and subsequent risks. This may provide a framework for future research, including randomized controlled trials or prospective cohort studies that control for the different subgroups. ◉

KEY POINTS

FINDINGS: Traumatic, microtraumatic, and atraumatic posterior shoulder instability (PSI) comprise different subgroups that are recognized and managed differently by expert clinicians.

IMPLICATIONS: Using the consensus for assessment and management defined by shoulder experts, a more consistent approach to managing PSI may be achieved by clinicians, with expectations for better outcomes.

CAUTION: Consensus may not reveal important prognostic indicators or the best management interventions.

STUDY DETAILS

AUTHOR CONTRIBUTIONS: All authors contributed to the conception and design of the study. Jackie Sadi, Erik Torchia, and Drs MacDermid and Faber were responsible for analysis and interpretation of the data. Jackie Sadi and Erik Torchia were responsible for drafting the manuscript. All authors revised the manuscript and approved the final version for publication.

DATA SHARING: Data are available on request. Data include round 2 and 3 Delphi questions and further demographic data.

PATIENT AND PUBLIC INVOLVEMENT: There was no patient or public involvement in this study.

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APPENDIX A

DELPHI POSTERIOR SHOULDER INSTABILITY

Participant Information

1. In which country do you currently practice?
   - ☐ Australia
   - ☐ Belgium
   - ☐ Canada
   - ☐ England
   - ☐ Scotland
   - ☐ United States
   - ☐ Other (specify)

2. Which type of professional are you?
   - ☐ Physical therapist: clinician
   - ☐ Physical therapist: researcher
   - ☐ Physician (orthopaedic surgeon)
   - ☐ Other (specify)

3. How many years of experience do you have treating musculoskeletal patients?
   - ☐ 1-5
   - ☐ 6-9
   - ☐ 10-20
   - ☐ >20

4. How many clients with suspected posterior shoulder instability do you see per year?
   - ☐ 0
   - ☐ 1-9
   - ☐ 10-19
   - ☐ 20-49
   - ☐ ≥50

Classification of Posterior Shoulder Instability

5. Do you believe that posterior shoulder instability should be classified according to the following criteria?

	Always	Sometimes	Never
Direction			
Unidirectional	☐	☐	☐
Bidirectional	☐	☐	☐
Multidirectional	☐	☐	☐
Stage			
Acute	☐	☐	☐
Chronic	☐	☐	☐
Mechanism			
Traumatic	☐	☐	☐
Microtraumatic	☐	☐	☐
Atraumatic	☐	☐	☐
Degree			
Dislocation	☐	☐	☐
Subluxation	☐	☐	☐

APPENDIX A

Do you have any additional suggestions about how posterior shoulder instability should be classified?

_____

_____

_____

Subjective Examination

6. How important are the following questions concerning the history of present injury?

	Very Important	Somewhat Important	Not Important
When was your initial injury?	☐	☐	☐
Did the problem begin due to a single event, or did it develop over a longer period of time?	☐	☐	☐
Do you remember the position your shoulder was in at the time of injury?	☐	☐	☐
Has your shoulder been getting worse (ie, getting more painful, able to use your shoulder less, more catching/clicking)?	☐	☐	☐

7. How important are the following questions concerning the patient's symptoms?

	Very Important	Somewhat Important	Not Important
Does your arm get fatigued easily with activity?	☐	☐	☐
Where is your pain located?	☐	☐	☐
What is your pain intensity?	☐	☐	☐
Is your injury on your dominant side?	☐	☐	☐
Can you make your shoulder pop in/out (subluxate/dislocate) on demand?	☐	☐	☐
Does your shoulder ever feel unstable or have the feeling that it may give way?	☐	☐	☐
Are there particular positions that make your arm worse, or that you avoid moving into?	☐	☐	☐
Do you get nerve-like pain in the arm (eg, pins and needles, numbness, shooting, buzzing sensations)?	☐	☐	☐
Do you get clicking or catching in the arm when moving it?	☐	☐	☐

Are there any other questions related to symptoms you believe should be asked?

_____

_____

_____

8. How important are the following questions concerning the patient's basic function?

	Very Important	Somewhat Important	Not Important
Do you have trouble pushing objects away from you (eg, push-up, bench press, etc)?	☐	☐	☐
Are you limited with any of your activities at home (eg, washing your hair, brushing your teeth, eating, etc)?	☐	☐	☐

Are there other questions you believe should be asked concerning basic function?

_____

_____

_____

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9. How important are the following questions concerning the patient's occupation?

	Very Important	Somewhat Important	Not Important
Do you work in a job that places high demands on your arm?	☐	☐	☐
Do you work in a job that requires overhead use of the arm?	☐	☐	☐

Are there other questions you believe should be asked concerning patient occupation?

_____

_____

_____

10. Do you believe that there are particular occupations that place more risk on the shoulder for acquiring posterior shoulder instability? (please state)

_____

_____

_____

11. How important are the following questions concerning sport and activity?

	Very Important	Somewhat Important	Not Important
Do you participate in a sport that requires repetitive arm motion?	☐	☐	☐
Do you participate in a contact sport?	☐	☐	☐
Do you participate in a sport that has a high risk of falling?	☐	☐	☐
At this moment, are you able to continue to play your sport?	☐	☐	☐

Are there any other questions that you believe should be asked concerning sport and activity?

_____

_____

_____

12. Do you believe that there are particular sports that place more risk on the shoulder for acquiring posterior shoulder instability? (please state)

_____

_____

13. How important are the following questions to be used in addition to those already stated above?

	Very Important	Somewhat Important	Not Important
What is your current age?	☐	☐	☐
Does any other member of your family have a history of loose joints (eg, dislocations, hypermobility, etc)?	☐	☐	☐
What is your main reason for seeking care?	☐	☐	☐
What are your goals of treatment?	☐	☐	☐

Are there any other questions you believe should be asked of your client with suspected posterior shoulder instability?

_____

_____

_____

APPENDIX A

Objective Examination

14. How important are the following components to your patient observation?

	Very Important	Somewhat Important	Not Important
Resting position of the humerus in relation to the acromion	☐	☐	☐
Dynamic motion of the shoulder blade through active range of motion	☐	☐	☐
Active range of motion of the shoulder, looking for aberrant motion	☐	☐	☐
Active range of motion of the shoulder, looking for blocked motion of external rotation	☐	☐	☐
Patient's ability to voluntarily subluxate or reduce the shoulder	☐	☐	☐
Identification of localized muscle hypertrophy	☐	☐	☐
Identification of localized muscle atrophy	☐	☐	☐
Identification of localized swelling	☐	☐	☐
Identification of bruising	☐	☐	☐
Identification to changes of bony contours	☐	☐	☐
Identification of skin dimpling	☐	☐	☐
Pain behaviors (including but not limited to wincing, hesitation to move the shoulder, holding the arm by the side)	☐	☐	☐

15. How important are the following components of tissue palpation?

	Very Important	Somewhat Important	Not Important
Palpation of the posterior joint line of the glenohumeral joint	☐	☐	☐
Palpation of distal pulses	☐	☐	☐
Palpation of the humeral head in relation with the acromion	☐	☐	☐
Palpation for increased muscle tone	☐	☐	☐

Any other important areas to palpate?

_____

_____

_____

16. How important are the following tests within your orthopaedic examination?

	Very Important	Somewhat Important	Not Important
Use of the posterior, inferior, and anterior passive translation of the humeral head	☐	☐	☐
Use of the posterior load and shift test	☐	☐	☐
Use of the posterior drawer test	☐	☐	☐
Use of the hand squeeze test	☐	☐	☐
Use of the Kim test	☐	☐	☐
Use of the jerk test	☐	☐	☐
Use of the sulcus sign	☐	☐	☐
Use of the Beighton exam for generalized hypermobility	☐	☐	☐
Use of the O'Brien test	☐	☐	☐
Use of the posterior apprehension test in arm flexion, adduction, and internal rotation with/without axial load	☐	☐	☐
Use of scapular repositioning for symptom modification	☐	☐	☐
Use of humeral head repositioning for symptom modification	☐	☐	☐
Assessment of shoulder strength with manual muscle testing or dynamometry	☐	☐	☐

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17. If you believe the sulcus sign is important, do you use it in combination with external rotation and/or internal rotation of the humerus?

	Yes	No
In combination with internal rotation	☐	☐
In combination with external rotation	☐	☐
With both internal rotation and external rotation	☐	☐

18. Do you believe the clustering of tests is important in the orthopaedic clinical exam?
    - ☐ Yes
    - ☐ No

    If yes, what clusters do you feel are important to use?

_____
_____
_____

19. Are there any other components or tests you believe should be used in the objective examination of a patient with potential posterior shoulder instability?

_____
_____
_____

20. Are there any specific movement patterns or muscle strength deficits that you believe are common in patients with posterior shoulder instability?

_____
_____
_____

Outcome Measures

21. How important are the following patient-reported outcome measures for clinical decision making with patients of posterior shoulder instability?

	Very Important	Somewhat Important	Not Important
Pain and function visual analog scale	☐	☐	☐
Subjective shoulder value or rating system	☐	☐	☐
Patient-Specific Functional Scale	☐	☐	☐
Rowe score for instability (or modified)	☐	☐	☐
University of California, Los Angeles activity rating scale	☐	☐	☐
Modified ASES score	☐	☐	☐
Western Ontario Shoulder Instability Index	☐	☐	☐
Disabilities of the Arm, Shoulder and Hand Questionnaire	☐	☐	☐
SF-36	☐	☐	☐
Oxford Shoulder Instability Score	☐	☐	☐
Shoulder Pain and Disability Index	☐	☐	☐
Melbourne Instability Shoulder Scale	☐	☐	☐
Quantification of past episodes of instability	☐	☐	☐
Patient satisfaction	☐	☐	☐

Abbreviations: ASES, American Shoulder and Elbow Surgeons; SF-36, Medical Outcomes Study 36-Item Short-Form Health Survey.

Are there any other self-reported measures you believe should be used with patients presenting with posterior shoulder instability?

_____
_____
_____

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22. How important are the following physical outcome measures for clinical decision making with patients with posterior shoulder instability?

	Very Important	Somewhat Important	Not Important
Range of motion	☐	☐	☐
Strength/muscle testing (with or without dynamometry)	☐	☐	☐
Functional testing	☐	☐	☐
Test load-transfer tasks with humeral head control	☐	☐	☐

Which outcome measures do you feel are more relevant to measure in this population? Are there outcomes outside of those reviewed that you believe should be used? (please state)

_____

_____

_____

23. Are there any other physical outcome measures you believe should be used with patients presenting with posterior shoulder instability? (please state)

_____

_____

_____

Risk/Prognosis

24. How important are the following risk factors for development of posterior shoulder instability?

	Very Important	Somewhat Important	Not Important
Family history of shoulder instability	☐	☐	☐
Younger than 40 years of age	☐	☐	☐
General joint laxity (high Beighton score)	☐	☐	☐
Voluntary self-subluxation	☐	☐	☐
Participation in sport/occupation with repetitive demands on the shoulder	☐	☐	☐
Participation in overhead sport/occupation	☐	☐	☐
Participation in contact sport	☐	☐	☐
Participation in sport that requires repetitive acceleration/deceleration of the arm (throwing/swinging)	☐	☐	☐

25. How important are the following characteristics in determining the prognosis of conservative management?

	Very Important	Somewhat Important	Not Important
Suspected microtraumatic posterior shoulder instability	☐	☐	☐
Suspected traumatic posterior shoulder instability	☐	☐	☐
Positive jerk test on initial assessment	☐	☐	☐
Retroversion of the humeral head	☐	☐	☐
Retroversion of chondrolabral portions of the glenoid	☐	☐	☐
Thinner posterior band of the inferior glenohumeral ligament	☐	☐	☐
Congenital anomalies of the humeral head, glenoid, or posterior ligaments	☐	☐	☐

26. Are there other factors that you believe may influence a positive outcome in patients with posterior shoulder instability?

_____

_____

_____

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27. Are there other factors that you believe may influence a negative outcome in patients with posterior shoulder instability?

_____

_____

_____

Timeline

28. Do you agree with the following timeline in regard to conservative care before a surgical consultation?

	Agree	Disagree
Immediate surgical consultation for those with a traumatic history of PSI and younger than 40 years of age	☐	☐
Immediate surgical consultation those with a traumatic history of PSI and older than 40 years of age	☐	☐
Immediate surgical consultation for those with a painful positive jerk test on initial assessment	☐	☐
3 months of conservative care for those with a traumatic history of PSI and older than 40 years of age	☐	☐
3 months of conservative care for those with a microtraumatic history of PSI	☐	☐
3 months of conservative care for those with a negative jerk test and a positive hand squeeze test on initial assessment	☐	☐
6 months of conservative care for those with a microtraumatic history of PSI	☐	☐

Abbreviation: PSI, posterior shoulder instability.

Are there other timelines that you consider in the care of a patient with posterior shoulder instability?

_____

_____

_____

Management of Microtraumatic and Atraumatic Posterior Shoulder Instability

Strategy 1: Education

29. How important do you consider the following positions/movements/activities to be modified, limited, or avoided?

	Very Important	Somewhat Important	Not Important
Pushing horizontally	☐	☐	☐
Positions of combined movement of horizontal adduction, flexion, and internal rotation (arm across body)	☐	☐	☐
Sleeping positions	☐	☐	☐
Overhead activities	☐	☐	☐
Weight-bearing activities	☐	☐	☐
Activities with risk of sudden jarring to the shoulder	☐	☐	☐
Throwing and swinging activities	☐	☐	☐

Are there any other positions/movements/activities you would like to additionally mention?

_____

_____

_____

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30. When limiting activity or exposure to a particular position, how do you monitor their use of the shoulder?

_____

_____

_____

31. How important are the following aspects to enable patient understanding regarding musculoskeletal education?

	Very Important	Somewhat Important	Not Important
Particular anatomy and pathomechanics	☐	☐	☐
Understanding of pain and coping strategies	☐	☐	☐
Optimal upper-quadrant posture and positions	☐	☐	☐
Optimal mechanics and motor control	☐	☐	☐

Are there any other aspects of musculoskeletal education you believe should be addressed with these patients?

_____

_____

_____

32. How important is it to discuss the following aspects of prognosis with your patient?

	Very Important	Somewhat Important	Not Important
The patient's potential prognosis	☐	☐	☐
The patient's expectation of outcome	☐	☐	☐
The patient's specific goals	☐	☐	☐
Importance of using exercises as prevention in a long run	☐	☐	☐
Rehabilitation plan from acute to return to work/sport (including potential timeline)	☐	☐	☐

Are there any other aspects of prognosis education you believe should be included with these patients?

_____

_____

_____

Strategy 2: Exercises

33. List 3 patient characteristics you think would make someone successful with an independent home exercise program.

1. _____
2. _____
3. _____

34. List 3 patient characteristics you think would make someone successful with supervision in a clinic.

1. _____
2. _____
3. _____

35. How important do you think the following positional/postural corrections need to be addressed with exercises?

	Very Important	Somewhat Important	Not Important
Humeral head correction	☐	☐	☐
Scapular correction	☐	☐	☐
Cranial/cervical correction	☐	☐	☐
Thoracic correction	☐	☐	☐

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36. How important is it to address the strength of the following muscle groups?

	Very Important	Somewhat Important	Not Important
Scapular muscles			
Upward rotators	☐	☐	☐
Retractors	☐	☐	☐
Posterior tilters	☐	☐	☐
Protractors	☐	☐	☐
Rotator cuff muscles			
External rotators	☐	☐	☐
Internal rotators	☐	☐	☐
Posterior deltoid	☐	☐	☐
Sport/occupation-specific training	☐	☐	☐
Other areas to consider			
Lower trunk	☐	☐	☐
Cervical	☐	☐	☐
Lower limb	☐	☐	☐

Are there any other aspects or categories of resistance training that you believe are valuable in the rehabilitation of a patient with posterior shoulder instability?

_____

_____

_____

37. Do you believe that a specific mode of training is more effective than others? (this may include differentiation between types of contraction, endurance versus strength, motor control, plyometrics, tempo, open versus closed kinetic chain, specific versus global shoulder training, etc)
    - ☐ Yes
    - ☐ No

38. Are there specific milestones that are reviewed to advance patients through their rehabilitation progression?
    - ☐ Yes
    - ☐ No

39. Is there a specific time frame that you believe should be used through the progression of exercise?
    - ☐ Yes
    - ☐ No

40. How important are the following tools/strategies in the rehabilitation of patients with posterior shoulder instability?

	Very Important	Somewhat Important	Not Important
Visual feedback (video, mirrors)	☐	☐	☐
Tactile feedback (manual correction)	☐	☐	☐
Neurofacilitation (proprioceptive neuromuscular facilitation, vibration techniques, etc)	☐	☐	☐
Electronic biofeedback	☐	☐	☐
Taping	☐	☐	☐
Use of external cuing	☐	☐	☐
Use of internal cuing	☐	☐	☐
Other (please specify):_____			

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Strategy 3: Manual Therapy

41. Do you believe manual therapy interventions are an effective form of management for patients with posterior shoulder instability?
    - ☐ Yes
    - ☐ No

    If yes, please state which forms of manual therapy you believe can/should be used:

_____

_____

_____

Management of Traumatic (Dislocation) Posterior Shoulder Instability

Acute Phase (physicians and surgeons only)

42. How important are the following aspects of joint reduction in the care of the traumatically dislocated shoulder?

	Very Important	Somewhat Important	Not Important
Closed reduction within a few hours (less than 24 hours)	☐	☐	☐
Closed reduction under intravenous sedation (opioid)	☐	☐	☐
Closed reduction using in-line longitudinal traction	☐	☐	☐
Closed reduction using gentle manipulation and external rotation	☐	☐	☐
Closed reduction under general anesthesia	☐	☐	☐

Are there other modes of joint reduction you believe are important in the care of the traumatically dislocated shoulder?

_____

_____

_____

43. Which of the following positions do you believe is best for immobilizing the traumatically dislocated shoulder post reduction?
    - ☐ Arm by side with forearm resting on abdomen in a sling
    - ☐ Abduction to 30°, with arm in internal rotation
    - ☐ Arm by side in 30° of external rotation
    - ☐ Other (please specify):_____

44. Which is the ideal length of time for immobilization post reduction?
    - ☐ 1 week
    - ☐ 3 weeks
    - ☐ 6 weeks
    - ☐ Other (please specify):_____

Subacute Phase (physicians and surgeons only)

45. During the immobilization phase, do you recommend the following:

	Always	Sometimes	Never
Shoulder pendulum/circumduction exercises	☐	☐	☐
Elbow active range of motion	☐	☐	☐
Wrist active range of motion	☐	☐	☐

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46. After immobilization, do you recommend the following:

	Always	Sometimes	Never
Referral to physical therapy	☐	☐	☐
Home exercise program	☐	☐	☐
No further follow-up	☐	☐	☐
Avoid pushing movements	☐	☐	☐
No contact sports for 6 weeks	☐	☐	☐
No contact sports for 16 weeks	☐	☐	☐
Other (please specify):_____			

47. After immobilization, do you prescribe the following:

	Yes	No
X-ray	☐	☐
Magnetic resonance imaging	☐	☐
Computed tomography scan	☐	☐
Ultrasound	☐	☐
Pain medications (nonopioids)	☐	☐
Pain medications (opioids)	☐	☐
Nonsteroidal anti-inflammatory medications	☐	☐
Other (please specify):_____		

Surgical Options (surgeons only)

48. Based on your knowledge/experience, which of the following is an indication that surgery is required?

	Very Important	Somewhat Important	Not Important
Initial traumatic episode	☐	☐	☐
Failed conservative approach	☐	☐	☐
Presence of an associated fracture with posterior dislocation	☐	☐	☐
Presence of a glenoid fracture greater than 20%	☐	☐	☐
Presence of a glenoid fracture less than or equal to 20%	☐	☐	☐
Presence of static subluxation	☐	☐	☐
Presence of dynamic subluxation	☐	☐	☐
Presence of a detached labrum	☐	☐	☐
Presence of an associated soft tissue injury (rotator cuff tear)	☐	☐	☐
Presence of a retroverted glenoid on X-ray greater than 15°	☐	☐	☐
Presence of a retroverted glenoid on X-ray less than or equal to 15°	☐	☐	☐

Are there other situations where a surgical approach would be considered?

☐ Yes
☐ No

APPENDIX A

49. Based on your knowledge/experience, to what extent should the following surgeries be considered for posterior instability?

	Always	Occasionally	Never
Labral repair	☐	☐	☐
Capsule plication	☐	☐	☐
Fragment fixation greater than 25%	☐	☐	☐
Fragment fixation less than or equal to 25%	☐	☐	☐
Retroversion: humeral osteotomy	☐	☐	☐
Retroversion: glenoid osteotomy	☐	☐	☐
Other (please specify):_____			

50. Post surgery, how important is physical therapy/physiotherapy?

- ☐ Very important
- ☐ Somewhat important
- ☐ Not important

APPENDIX B

PILOT SURVEY FEEDBACK

Feedback

	Result
1. Please complete the entire survey and state how long it took to complete	Mean ± SD survey completion time, 44 ± 14 minutes
2. Please list which questions or items within each question require further information or additional items, removal, or rewording	Refer to table below
3. Which questions do you feel the physical therapists should complete, and which questions should the physicians and orthopaedic surgeons complete?	The majority of panelists agreed on the proposed division of questions among professions
4. What barriers do you feel may prevent a participant from completing all 3 rounds of this e-Delphi study?	Identified barriers included time (n = 6), limited to online access (n = 2), and survey language being limited to English (n = 1)
5. Do you feel the "open boxes" within the survey are helpful?	Unanimous acceptance of open comment boxes to be used in conjunction with Likert selection

Answers to Question 2

Questionnaire Category	Questions per Category, n	Participants With Feedback, n	Feedback
Participant information	4	0	Not available
Classification	1	5	Confusing question
		2	Add a question on percentage of PSI patients classified in each category
Subjective examination	8	1	Add descriptors of patient symptoms (eg, feeling or of nervousness)
		2	Clarify or add examples of patient's function and/or occupation restrictions (eg, reaching for seatbelt)
Objective examination	7	4	Unfamiliar with clinical exam techniques or test designed for particular settings (eg, under anesthesia)
		1	Add components of patient's observation (eg, hand behind back)
Outcome measures	3	7	Unfamiliar with the measures, specific relevance of measures to PSI, and usefulness in clinical practice
Risk/prognosis	4	2	Clarification requested
Timeline	1	0	Not available
Nonsurgical management of PSI	13	2	Add specific PSI questions in the educational component of care, and in the exercise implementation strategies
		3	Unfamiliar with internal and external cuing
		2	Clarify or add components of patient's activity limitations and add proprioception as a specific mode of training
Management of traumatic dislocation	9	2	Add "avoidance of contact sport for a minimum of 6 months"

Abbreviation: PSI, posterior shoulder instability.

APPENDIX C

OVERALL POSTERIOR SHOULDER INSTABILITY AGREEMENT

Subjective/Clinical History Questions for All Subgroups

1. What is your age? (84% agreement)
2. Did the problem begin due to a single event, or did it develop over a longer period of time? (96% agreement)
3. What is your main reason for seeking care? (90% agreement)
4. What are your goals of treatment? (96% agreement)

Symptom Questions for All Subgroups

1. Is weakness or decreased performance a major concern? (98% agreement)
2. Does your shoulder feel unstable or have the feeling that it may give way? (96% agreement)
3. Are there particular positions that you avoid due to a "giving out" sensation? (92% agreement)
4. Do you have other joints that feel unstable, subluxate, or dislocate? (96% agreement)
5. Are there particular positions that specifically bring on pain location? (78%-90% agreement)
6. Do you get clicking, clunk, or catching with your shoulder motion? (96% agreement)

Risk/Prognosis Questions for All Subgroups

1. Do you participate in contact sports? (98% agreement)
2. Do you participate in a sport/occupation with repetitive demands on the shoulder? (98% agreement)?
3. Do you have a family history of shoulder subluxation/dislocation? (71% agreement)
4. How many times has your shoulder subluxated or dislocated? (86% agreement)

Assessment for All Subgroups

- Range of motion, manual muscle testing, and motor control testing should be done at the discretion of the clinician, based on mechanism of injury (87% agreement)

Functional Limitations for All Subgroups

- Intolerance for weight bearing or pushing through the arms (eg, plank position, push-up, bench press, pushing a door open, etc) (88%-96% agreement)
- Intolerance for reaching across the body (eg, putting on a seatbelt, brushing teeth, pulling off a tight shirt/bra, etc) (78%-94% agreement)

Outcome Measures for All Subgroups

- Self-report
  - Number of episodes/times per year the shoulder is subluxated or dislocated (96% agreement)
  - Western Ontario Shoulder Instability Index (96% agreement)
  - Numeric pain-rating scale (91% agreement)
  - Single Assessment Numeric Evaluation (89% agreement)
- Physical outcome measures
  - Some form of functional testing for sport, occupation, or activities of daily living (eg, pushing out of chair, lifting overhead, reaching across body with resistance, etc) (94% agreement)

Recommendations for High-Risk Sport/Work

- Recommendations for activity limitations: during acute or irritable phase, patients should modify, limit, or avoid positions of combined horizontal flexion, adduction, and internal rotation (ie, arm across body) with/without axial load (92% agreement)
- Return to high-risk work/sport: post immobilization and after receiving 3 to 6 months of physical therapy (no surgery) (70% agreement)
- Return to high-risk work/sport: post immobilization and after receiving 6 to 12 months of physical therapy (post surgery) (96% agreement)

Overall Management

- Education regarding injury and prognosis that all patients with posterior shoulder instability should learn about:
  - Rehabilitating shoulder for optimal motor control and strength (81% rated very important)
  - Anatomy/pathomechanics (78% rated very important)
  - Pain coping strategies (72% rated very important)
- Factors for successful nonsurgical management of posterior shoulder instability
  - Willingness of patient to adhere/participate in rehabilitation (100% agreement)

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- Positive expectations for rehabilitation and exercise (98% agreement)
- Patients are provided with staged exercise program, with motor control and increased load (90% agreement)
- Patients are knowledgeable about their condition and the value of rehabilitation (98% agreement)
- Therapist is familiar with care of posterior shoulder instability (90% agreement)
- Improvement of symptoms with scapular and/or humeral head modifications (90% agreement)

• Factors for unsuccessful nonsurgical management of posterior shoulder instability
- Negative beliefs or expectations about nonsurgical management (94% agreement)
- Large traumatic structural lesions to glenoid or humeral head (89% agreement)
- Belief that only surgery will correct the posterior shoulder instability (75% agreement)

• Considerations for home-based exercise programs
- Motivation to perform at home (100% agreement)
- Understanding and knowledge of home exercises (100% agreement)
- High expectations that home exercises will be successful (94% agreement)

• Considerations for clinician-supervised exercise program
- Low efficacy (83% agreement)
- Poor support at home (81% agreement)
- Sedentary lifestyle (75% agreement)
- Requires verbal and tactile feedback (100% agreement)
- Patient reports low motivation for home exercises (91% agreement)
- Lower level of education or lacks insight into exercises (90% agreement)

Timelines for

• Referral to surgery: see recommendations for each of the 3 posterior shoulder instability subgroups in **TABLE 3**

• Return to high-risk sport/work: see recommendations for each of the 3 posterior shoulder instability subgroups in **TABLE 3**

APPENDIX D

TRAUMATIC, MICROTRAUMATIC, AND ATRAUMATIC POSTERIOR SHOULDER INSTABILITY POST ROUND 1, 2, AND 3 CONSENSUS

Traumatic

An injury that requires an immediate and/or forceful impact to cause a posterior or posteroinferior subluxation/dislocation of the humerus on the glenoid (100% agreement)

Clinical History

Mechanism of injury: fall or unexpected weight bearing/pushing into horizontal flexion/internal rotation or flexion (60°-140°) with adduction and internal rotation (85% agreement)

Occupations at risk: tactical (eg, firefighter, military, police officer, etc) (98% agreement), performing artist (eg, acrobat, martial artist, stunt performer, etc) (81% agreement)

Sports at risk: contact sports (eg, American football, rugby, ice hockey) (98% agreement), sports with increased fall risk (eg, cheerleading, figure skating, skateboarding, gymnastics) (94% agreement), combat sports (eg, karate, judo, wrestling, jiujitsu) (85% agreement)

Occupation- or sport-related shoulder demands: pushing, falling, or weight bearing with shoulder elevated between 60° and 140° of flexion, with or without adduction with internal rotation (79% agreement)

Questions to ask:

- Do you remember the position your shoulder was in at the time of injury? (100% agreement)
- When was your initial injury? (96% agreement)

Type: acute (98% agreement), dislocation (96% agreement), posterior dislocation direction (98% agreement), posteroinferior dislocation direction (96% agreement after round 3)

Symptoms: acute pain with loss of shoulder mobility in all directions, shoulder feels unstable or may give way (94% agreement after round 3), pain location: posterior more than anterior (82% agreement after round 3)

Functional limitations: intolerance for weight bearing or pushing through the arms (eg, plank, push-up, bench press, pushing a door open) (88% agreement)

Clinical Examination

Observation: pain behaviors: wincing, hesitation to move the shoulder, holding arm by side (75% agreement)

Active motion: horizontal flexion, adduction, internal rotation: limited secondary to pain or apprehension, external rotation, and/or hand behind back (limited range) (85% agreement)

Tests: posterior apprehension/jerk/Kim test (92% agreement), posterior load and shift (85% agreement), and/or posterior drawer test (80% agreement)

Strength deficits: acute dislocation: all strength tests would be painful and weak (79% agreement)

Outcome Measures

These outcome measures were common in all subgroups of posterior shoulder instability:

- Self-report
  - Episodes/times per year the shoulder is subluxated or dislocated (96% agreement)
  - Numeric pain-rating scale (91% agreement)
  - Single Assessment Numeric Evaluation (89% agreement)
  - Western Ontario Shoulder Instability Index (96% agreement after round 3)
- Physical outcome measures
  - Some form of functional testing for sport, occupation, or activities of daily living (ie, pushing out of chair, lifting overhead, reaching across body with/without resistance, etc) (94% agreement)

Management

- Medical: acute trauma
  - X-ray prior to reduction (97% rated very important)
  - Closed reduction in the emergency department (86% agreement), with consideration for duration of dislocation, evidence of locked humeral head, or deep reverse Hill-Sachs lesion on radiographs
  - Closed reduction in the operating room if presence of fracture, degree of reverse Hill-Sachs lesion, or locked humeral head
  - Immobilization in 30° of external rotation with neutral abduction (74% agreement) for 1 to 3 weeks (81% agreement)
  - Nonopioid pain medication (86% rated always) and nonsteroidal anti-inflammatory drugs (75% rated always)
  - Refer to physical therapy (77% rated always)

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- Recommend elbow and wrist range-of-motion exercises (84% rated always)
- Physical therapy
  - Minimum of 12 weeks of individualized exercise progression (87% agree to strongly agree)
  - Limit arm-across-body activities during acute/irritable phase (92% agreement)
  - Scapular, rotator cuff, and sport/occupation-specific strength training as needed (92% agreement)
- Surgery
  - Large bony structural lesion (89% agreement)
  - Fragment fixation greater than 25% (79% rated very important)
  - Labral repair (76% rated very important)
  - Failed nonsurgical management after 3 months (86% agreement)

Timelines for

- General recovery: pain/activities of daily living—6 to 12 weeks (77% agreement)
- Immobilization in 30° of external rotation with neutral abduction (74% agreement) for 1 to 3 weeks (81% agreement)
- Referral for surgery: immediately if there are large structural bony lesions to the glenoid or humeral head (89% agreement) or after 3 months if not responding to physical therapy or nonsurgical management (86% agreement)
- Return to high-risk work/sport: post immobilization and after receiving 3 to 6 months of physical therapy (no surgery) (70% agreement)
- Return to high-risk work/sport: post surgery and after receiving 6 to 12 months of physical therapy, based on individualized discussion with patient (96% agreement after round 3)

Microtraumatic

A posterior or posteroinferior subluxation/dislocation of the humerus on the glenoid, with or without degenerative changes, and associated with gradual or acute overload of the musculature (98% agreement)

Clinical History

Mechanism of injury: tasks that involve repetitive or increased load with pushing or weight bearing through the straight arm, or reaching across body, or overhead tasks (94% agreement after round 3)

Occupations/sports at risk: highly repetitive overhead activity (eg, swimmer, baseball pitcher, tennis player, manufacturing laborer) (94% agreement), sports with overhead activity with heavy load (eg, weightlifter) (89% agreement), performing artist (eg, acrobat, dancer, martial artist, stunt performer) (90% agreement)

Occupation- or sport-related shoulder demands: repetitive—overhead (92% agreement); horizontal flexion (96% agreement); horizontal flexion, adduction, and internal rotation (100% agreement); pushing, falling, or weight bearing through the arms between 60° and 140° of flexion (77% agreement)

Question to ask:

- Did the problem begin due to a single event or over a period of time? (96% agreement)

Type: functional subluxations (85% agreement), episodic (fewer than 3 subluxations/dislocations per year) (86% agreement), chronic (more than 3 subluxations/dislocations per year) (84% agreement), unidirectional (posterior, 77% agreement), bidirectional dislocations/subluxations (more than 1) (posteroinferior, 76% agreement)

Symptoms: functional instability—self-subluxation (84% agreement), night pain/disturbed sleep (92% agreement), catching/clicking with shoulder motion (96% agreement), nerve-like pain in arm (77% agreement), arm fatigues easily (94% agreement)

Functional limitations: intolerance for weight bearing or pushing through the arms (eg, plank position, push-up, bench press, pushing open a door, etc) (96% agreement)

Clinical Examination

Observation: patients may be able to voluntarily subluxate or reduce the glenohumeral joint (100% agreement)

Active motion: aberrant active shoulder and scapular motion (90% agreement), apprehension with horizontal flexion/adduction/internal rotation, decreased or locked external rotation (87% agreement)

Tests or cluster of tests: posterior apprehension/jerk test (100% agreement), posterior drawer test (84% agreement), or subjective history plus posterior apprehension plus scapular and/or humeral head repositioning tests with symptom or strength improvement (80% agreement)

Strength deficits: weak scapular upward rotators (upper and lower trapezius, serratus anterior) (74% agreement)

Outcome Measures

- Self-report
  - Episodes/times per year the shoulder is subluxated or dislocated (96% agreement)
  - Numeric pain-rating scale (91% agreement)
  - Single Assessment Numeric Evaluation (89% agreement)

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- Western Ontario Shoulder Instability Index (96% agreement after round 3)
- Physical outcome measures: some form of functional testing for sport, occupation, or activities of daily living (ie, pushing out of chair, lifting overhead, reaching across body with/without resistance, etc) (94% agreement)

Management

- Recommendations for activity limitations: during acute or irritable phase, patients should modify, limit, or avoid positions of combined horizontal flexion, adduction, and internal rotation (ie, arm across body) with/without axial load (92% agreement)
- Physical therapy
  - Assess and manage scapular and/or humeral head position (100% agreement)
  - Scapular upward rotators, rotator cuff muscles, and sport/occupation-specific strength training should be addressed (98% agreement)
  - Exercise progression should encompass local and global muscles, with progression through motor control to endurance to strength to functional retraining (72% agreement)
  - Emphasis is on exercise progression, but manual therapies are considered acceptable (96% agreement) if defined as active feedback using various forms of tactile touch, mobilization with movement, or manual repositioning of the scapula or humerus
- Medical
  - Refer for physical therapy (96% agreement)
  - Nonsteroidal anti-inflammatory drugs only during acute phase (75% agreement)
  - Immobilization post reduction only in 30° of external rotation with neutral abduction (74% agreement) for 1 to 3 weeks (81% agreement)
  - Modify or limit horizontal adduction, flexion, and internal rotation initially (92%)
- Surgery
  - Referral for surgery should be considered after 6 months if physical therapy or nonsurgical management is unsuccessful (73% agreement)

Timelines for

- General recovery: pain/activities of daily living—6 to 12 weeks (77% agreement)
- Immobilization post reduction: 1 to 3 weeks (81% agreement)
- Return to high-risk work/sport: no surgery and after receiving physical therapy for 3 to 6 months (70% agreement)
- Return to high-risk work/sport: post surgery and after receiving physical therapy for 6 to 12 months, based on individualized discussion with patient (96% agreement after round 3)

Atraumatic

A subluxation/dislocation of the humerus on the glenoid in a posterior or posteroinferior direction due to congenital and/or systemic laxity of the ligamentous, labral, or capsular glenohumeral structures, or congenital anomalies of the bony glenoid or humerus (98% agreement)

Clinical History

Mechanism of injury: tasks that involve pushing or weight bearing through the straight arm or reaching across body (92% agreement), repetitive activities that include overhead or horizontal flexion, adduction, or internal rotation activities (79% agreement)

Occupations/sports at risk: athletic-based performing artist (acrobat, dancer, martial artist, stunt performer, etc), weightlifter (73% agreement)

Occupation- or sport-related shoulder demands: repetitive—overhead (79% agreement); horizontal flexion (89% agreement); horizontal flexion, adduction, and internal rotation (92% agreement)

Questions to ask:

- Do you have other joints in your body that you can dislocate or subluxate? (100% agreement)
- Do you have a family history of connective tissue disorders? (eg, Ehlers-Danlos, Marfan syndrome, general hypermobility syndrome) (100% agreement)

Type: functional subluxations (94% agreement), chronic (more than 3 subluxations/dislocations per year) (94% agreement), multidirectional (96% agreement), bidirectional posterior/inferior subluxations (84% agreement)

Symptoms: arm fatigues easily (92% agreement), functional instability—self-subluxation (90% agreement), night pain/disturbed sleep (90% agreement), catching/clicking with shoulder motion (86% agreement), nerve-like pain in arm (84% agreement), intolerance for lying on affected side (79% agreement)

Signs: can make shoulder pop in/out or demonstrate generalized shoulder laxity (98% agreement)

Functional limitations: functional instability is primary limiting complaint (90% agreement), intolerance for lying on affected shoulder (79% agreement)

Clinical Examination

Observation: patients able to voluntarily subluxate or reduce the glenohumeral joint (100% agreement)

Active motion: aberrant active shoulder and scapular motion (96% agreement), apprehension with horizontal flexion/adduction/internal rotation, decreased or locked external rotation (91% agree)

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Cluster of tests: subjective history plus Beighton score greater than 4/9, positive sulcus test (internal rotation or external rotation), scapular and/or humeral head repositioning with/without improvement in muscle strength or symptoms (93% agreement)

Strength deficits: weak scapular upward rotators and outer ranges of overhead glenohumeral range of motion (78% agreement)

Outcome Measures

- Self-report
  - Episodes/times per year the shoulder is subluxated or dislocated (96% agreement)
  - Numeric pain-rating scale (91% agreement)
  - Single Assessment Numeric Evaluation (89% agreement)
  - Western Ontario Shoulder Instability Index (96% agreement after round 3)
- Physical outcome measures
  - Some form of functional testing for sport, occupation, or activities of daily living (ie, pushing out of chair, lifting overhead, reaching across body with/without resistance, etc) (94% agreement)

Management

- Recommendations for activity limitations: during acute or irritable phase, patients should modify, limit, or avoid positions of combined horizontal flexion, adduction, and internal rotation (ie, arm across body) with/without axial load (92% agreement)
- Physical therapy: based on physician, physical therapist, and orthopaedic surgeon agreement
  - Assess and manage scapular and/or humeral head position (100% agreement)
  - Scapular upward rotators, rotator cuff muscles, and sport/occupation-specific strength training should be addressed (98% agreement)
  - Exercise progression should encompass local and global muscles, with progression through motor control to endurance to strength to functional retraining (72% agreement)
  - Emphasis is on exercise progression, but manual therapies are considered acceptable (96% agreement) if defined as active feedback using various forms of tactile touch, mobilization with movement, or manual repositioning of the scapula or humerus
- Medical: based on physician agreement only
  - Refer for physical therapy (96% agreement)
  - Nonsteroidal anti-inflammatory drugs only during acute phase (75% agreement)
  - Immobilization post reduction only in 30° of external rotation with neutral abduction (74% agreement) for 1 to 3 weeks (81% agreement)
  - Modify or limit horizontal adduction, flexion, and internal rotation initially (92% agreement)
- Surgery: based on orthopaedic surgeon agreement only
  - Referral for surgery should be considered after 6 months if physical therapy or nonsurgical management is unsuccessful (77% agreement)

Timelines for

- General recovery: pain/activities of daily living—6 to 12 weeks (77% agreement)
- Immobilization post reduction: 1 to 3 weeks (81% agreement)
- Return to high-risk work/sport: no surgery and after receiving 3 to 6 months of physical therapy (70% agreement)
- Return to high-risk work/sport: post surgery and after receiving 6 to 12 months of physical therapy (post surgery) (96% agreement after round 3)